Appendix 7

Solar Energy Heating System Design
and
Cost Saving Projections

Sun, Wind and Fire
Alternative Energy Supply Co., Inc.
7637 S.W. 33rd Ave.
Portland, Oregon 97219
(503) 245-2661

City of Elgin
Community Center Pool

Prediction of Performance and Energy Savings.

The Elgin Community Center Pool is an inground 36'x60' outdoor pool. Currently heated with a natural gas heater to 80°F during the months of June, July and August. A solar type insulated blanket is installed over the pool for nine hours per day, every day.

Based on micro climate data on solar insolation for the Spokane, WA., area, a predicted performance is established using an IBM Computer, test data on the thermal performance of the Solar Industries SP 4'x12' solar collector, pool covers used, length of season, temperature and other relevant data.

It will be important to remember that when comparing the predicted performance of the solar system to the amount of dollars saved on fuel, that we compare only the months of June, July and August. This is because historical data (gas bills) from the community center only include data (gas bills) for June, July and August.

Information provided to me by the O.S.U. Energy Extension service indicate that the cost of heating the Community Pool is as follows:

		Therms	Cost
1988	June	2990	1524.90
	July	2612	1332.12
	August	522	266.22
	TOTAL		3123.24

The computer predicted performance of 45 4'x12' Solar Industries Collectors mounted on the South facing roof of the community center pool building are as follows:

	Solar Savings
June	100%
July	100%
August	100%

Energy savings in the form of dollars saved by installing the solar system is as follows based on the 1988 natural gas bills.

June	1524.90
July	1332.12
August	266.22
TOTAL	3123.24

It is important to note that when comparing the natural gas bills for 1986, 1987 and 1988, that 1988 includes a longer swimming day from 6:00 a.m. to 9:00 p.m., and therefore required more natural gas to heat the swimming pool. It is assumed that the Community Center will continue the longer operating hours.

Questions and comments may be directed to me at Sun, Wind and Fire Company. Thank you.

Sincerely,

SUN, WIND AND FIRE CO.

R. Brent Gunderson
President

Enclosures

CC: David Koller, O.S.U. Energy Estension

RBG:ds

Sun, Wind and Fire
Alternative Energy Supply Co., Inc.
7637 S.W. 33rd Ave.
Portland, Oregon 97219
(503) 245-2661

December 22, 1988

City of Elgin
Community Center Pool

Estimate of cost for Solar Pool Heating System.

Solar System consists of 45 4'x12' Solar Panels, all controls, pipe and hardware including installation.

Total System Estimate	$ 21,180.50
Materials only - including above, less installation	$ 18,280.50
Installation Labor only	$ 2,900.00

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*****************************************
*                F-CHART                *
*      IBM PC  VERSION 5.5   05/27/85   *
*              COPYRIGHT BY             *
*       S.A. KLEIN & W.A. BECKMAN       *
*              ANALYSIS BY              *
*         SUN, WIND AND FIRE CO.        *
*            7637 SW 33RD AVE           *
*         PORTLAND, OREGON 97219        *
*             (503) 245-2661            *
*****************************************
SPOKANE          WA            01-01-1980

CITY OF ELGIN, COMMUNITY CENTER POOL

      *** POOL HEATING SYSTEM ***
       ** FLAT PLATE COLLECTOR **
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	OCOLL MMBTU	OPOOL MMBTU	LOAD MMBTU	AUX MMBTU	F
MAY	45.7	107.4	66.3	20.6	0.69
JUN	59.7	112.9	27.3	0.0	1.00
JUL	98.6	132.0	0.0	0.0	1.00
AUG	82.4	108.8	19.0	0.0	1.00
SEP	49.7	77.8	74.6	24.9	0.67
YR	336.1	539.0	187.2	45.5	0.76

1	CITY CALL NUMBER.....	202	
2	POOL SURFACE AREA.....	2160	FT2
3	AVERAGE POOL DEPTH.....	5	FT
4	POOL TEMPERATURE.....	80	F
5	FIRST MONTH OF SEASON (1-12)..	5	
6	LAST MONTH OF SEASON (1-12)...	9	
7	COVER (0=NONE,1=FILM,2=BUBBLE)	1	
8	HOURS PER DAY COVERED.....	9	HR/DAY
9	% OF TIME SHADED.....	0	%
10	AVG WINDSPEED AT POOL SURFACE.	0	MILES/HR
11	FUEL (1=EL,2=NG,3=OIL,4=OTHER)	2	
12	EFFICIENCY OF FUEL USAGE.....	70	%
13	PIPE HEAT LOSS (1=Y,2=N).....	2	
14	INLET PIPE UA.....	5	BTU/HR-F
15	OUTLET PIPE UA.....	5	BTU/HR-F

1	NUMBER OF COLLECTOR PANELS....	45	
2	COLLECTOR PANEL AREA.....	48	FT2
3	FR*UL (TEST SLOPE).....	3.67	BTU/HR-FT2-F
4	FR*TAU*ALPHA (TEST INTERCEPT).	.823	
5	COLLECTOR SLOPE.....	30	DEG
6	COLLECTOR AZIMUTH (SOUTH=0)...	0	DEG
7	INCIDENCE ANGLE MOD TYPE(8-10)	8	
8	NUMBER OF GLAZINGS.....	0	
9	INC ANGLE MODIFIER CONSTANT.	0	
10	INC ANGLE MODIFIER VALUE(S).		
	1 .999 .998 .995 .981 .953 .882		
	.7 .35 0		
11	COLLECTOR FLOWRATE/AREA.....	55	LB/HR-FT2
12	COLLECTOR FLUID SPECIFIC HEAT.	1	BTU/LB-F
13	MODIFY TEST VALUES (1=Y,2=N)..	2	
14	TEST COLLECTOR FLOWRATE/AREA	11	LB/HR-FT2
15	TEST FLUID SPECIFIC HEAT....	1	BTU/LB-F

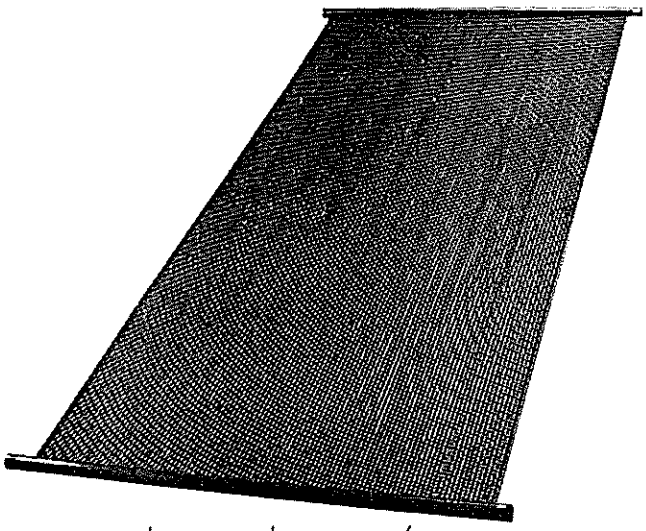
Film No wind

Solar Industries

AQUA THERM SP SOLAR COLLECTOR

"Built to perform, built to last"

- **Proven Performance In All Climates** - heat trap design gives better all-day performance even on windy days.
- **Patented Tube and Curved Web Design** - relieves stress caused by expansion and contraction for longer life.
- **Stainless Steel Mounting Hardware** - greater strength and rust free with fewer mounting points for easy installation.
- **Made In The U.S.A.** - backed by a Lifetime Limited Warranty.



AQUA-THERM SP CROSS SECTION-ACTUAL SIZE

Technical Data

DIMENSIONS

Model Number	11051	11001	11002	11011	11003
Nominal Size-ft.	4 x 12	4 x 10	4 x 8	4 x 6	4 x 4
Overall Panel Length-in.	144.0	120.0	96.0	72.0	48.0
Panel Width-in.	47.0	47.0	47.0	47.0	47.0
Manifold Length-in.	51.0	51.0	51.0	51.0	51.0
Manifold O.D.-in.	1.9	1.9	1.9	1.9	1.9
Manifold I.D.-in.	1.5	1.5	1.5	1.5	1.5
Gross Collector Area-ft²	47.3	39.3	31.4	23.6	15.8
Net Collector Area-ft²	47.3	39.3	31.4	23.6	15.8

WEIGHTS

Dry-lbs.	21.3	17.1	14.3	11.5	8.4
Wet-lbs.	48.0	41.6	35.1	28.6	21.8
Wet-lbs./ft²	1.01	1.06	1.12	1.21	1.38
Fluid Capacity-gal.	3.2	2.9	2.5	2.1	1.6

FLUID FLOW RATES

Maximum-GPM	10.0	10.0	10.0	10.0	10.0
Minimum-GPM	3.0	2.5	2.5	2.5	2.0
Recommended-GPM	5.0	4.0	3.25	3.0	2.0
Max. Panels with Single Feed @ Recommended Flow Rate	10	12	14	16	24

PRESSURES

Pressure Drop	0.30 ft. head (0.13PSI) pressure loss @ recommended flow rate 0.20 ft. head (0.09PSI) pressure loss @ minimum flow rate
Max. Fluid Pressure	Greater than 85PSI @ 80°F
Recommended Max. Operating Pressure	35 PSI @ 140°

MATERIALS

Absorber Plate

Propylene copolymer with synergistic antioxidants and UV screen including carbon black

Hold-Down Straps

Polypropylene coated stainless steel (Type 302)

Connecting Hoses

EPDM (ethylene-propylene-diene-terpolymer)

Clamps and Brackets

Stainless steel (Type 302)

APPROVALS

Florida Solar Energy Center, Dade and Palm Beach County, Fla., City of Ft. Lauderdale, Arizona Solar Energy Commission, New Mexico Solar Energy Institute, State of Wisconsin, International Association of Plumbing and Mechanical Officials.

AQUA-THERM SP THERMAL PERFORMANCE RATINGS

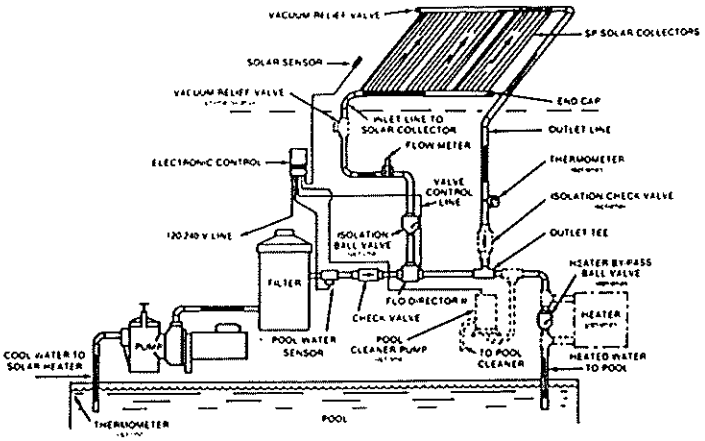
Thermal Performance Equation - n = 82.3 -3.670x
Incident Angle Modifier-Kqr = 1.0 - 0.040k
Time Constant- 1 minute
(Rated in accordance with ASHRAE standard 96-80)

Florida Solar Energy Center Certification
(BTU's per standard day)

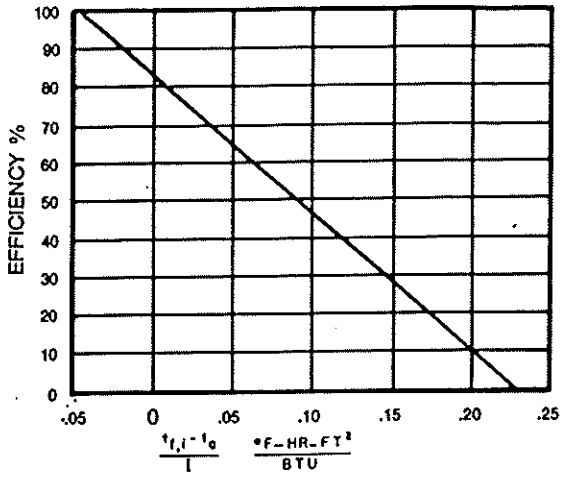
4 x 12-41,100	4 x 8 - 27,100	4 x 4 - 13,500
4 x 10-34,200	4 x 6 - 20,300	

Specifications subject to change without notice.

SYSTEM DIAGRAM

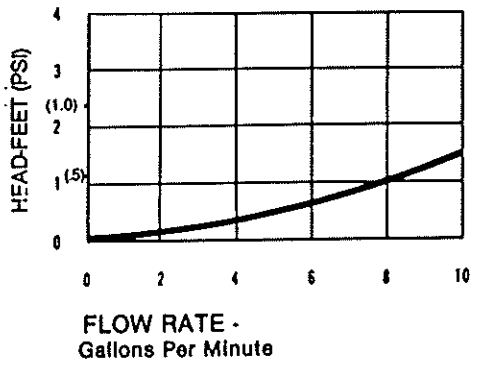


INSTANTANEOUS EFFICIENCY OF SP SERIES COLLECTORS

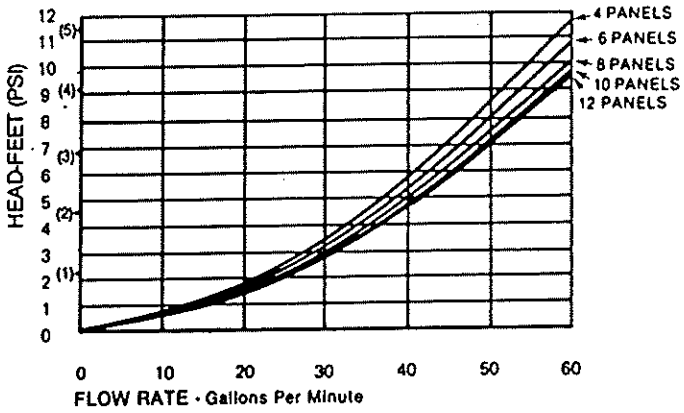


TESTED IN ACCORDANCE WITH ASHRAE STANDARD 96-80

HEAD PRESSURE LOSS OF A SINGLE 4' x 10' SP SERIES COLLECTOR



HEAD PRESSURE LOSS OF MULTIPLE 4' x 10' SP SERIES COLLECTOR



SP GUIDE SPECIFICATIONS

Contractor to supply and install_____panels, nominal size (4' x 12', 4' x 10', 4' x 8') with overall frontal area of (47.3, 39.3, 31.4) square feet each. Panels shall be fabricated from a propylene copolymer with stabilizer combination providing long term resistance to heat and light. The weight of collector when filled with water shall be no more than 1.12 pounds per square foot of frontal area. The panels shall be capable of withstanding an internal static pressure of 85 psi at operating temperature. The panel shall be resistant to corrosion, freezing and internal scale accumulation.

Panels shall be capable of thermal performances of at least 82% efficiency when inlet fluid temperature equals ambient temperature and be capable of collecting solar energy when inlet fluid temperature exceeds 55° with solar insolation of 250 BTU per square foot per hour.

Pressure head loss of a single panel must not exceed 0.40 feet water at recommended flow rate.

Header length shall be 51 inches.

Panel mounting shall consist of 18-8 chromium-nickel stainless steel mounting hardware with two continuous transverse straps having black polypropylene coating. Transverse straps shall be fastened with 18-8 chromium-nickel stainless steel clamps and brackets.

Water connections shall be made with hose sections extruded from EPDM (ethylene-propylene-diene-terpolymer) 70 durometer minimum hardness. Hose clamps shall be all stainless worm gear type with 18-8 chromium-nickel stainless band.

The panels shall comply with the requirements specified in the International Association of Plumbing and Mechanical Officials' Uniform Solar Energy Code, latest Edition and other applicable nationally recognized standards, and shall be manufactured in the U.S.A.

Solar Industries

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